

**REMARKS**

Claims 35 to 57 are pending in the application.

**Rejection under 35 U.S.C. 103**

Claims 35 to 57 stand rejected under 35 U.S.C. 103 (a) as being unpatentable over *Ritter* (WO 96/37544) and *Krishnan et al.* (US 5,500,465).

In the previous office action the examiner argued that *Ritter* discloses a method for production of multicomponent mixtures based on polyvinyl acetate, vinyl alcohol, organic fillers, alkali silicate (water glass) and calcium ion-supplying compounds and that starch and glycerol are set forth as useful ingredients in this process. In examiner's view, the process of the cited prior reference reads on the claimed process of the instant application. The examiner furthermore points out that the quantities of raw materials are also similar to those claimed in the instant application.

The examiner furthermore cites *Krishnan et al.* as disclosing organofunctional silanes in a similar application so that it would be obvious to use them in the instant process/component.

In the instant office action the examiner argues in regard to the newly presented claims 35 to 57 that the use of water glass in dry form and not as a solution makes no difference since the water glass is going to be mixed with water and therefore form a solution.

In the instant office action the examiner states that the instant claims do not encompass any time-based limitation and that applicants have not provided any evidence in support of the argument, that the compounds in the reaction mixture are allowed to react for an extended period of time.

The Examiner further states that the argument that *Ritter* uses water glass as a filler is not convincing since it is likely that the water glass may react unless provided otherwise. The examiner further states that it is immaterial what the ingredient of a composition is called.

The examiner further states that the rough surface cannot be ascribed to the presence of the filler alone.

The argument that the short reaction time of the prior art versus a longer reaction

time of the present invention makes a difference in regard to the product is refuted by the examiner firstly because there is no such limitation in the claims and secondly because there is no evidence to support the argument.

The examiner also states that the fact that *Ritter* does not suggest presaponification is not convincing since the presaponification is inherent in the process of *Ritter*.

The examiner further states that the water content and the pH are not relevant since it is within one's expertise to vary the values to produce an expected end product.

In order to be able to address the issues raised by the examiner, applicant submits a partial translation of *Ritter* (WO 96/37544). The translation has been prepared by the undersigned who is fluent in the German and English languages. The undersigned herewith states that the attached English translation of page 3, line 11, to page 7, 6th line from the bottom, of WO 96/37544 is an accurate translation.

First of all, it should be pointed out that, contrary to examiner's remarks in the instant office action, claims 35, 50, 52 as submitted with the amendment of May 27, 2003, do contain a limitation in regard to the reaction time. It is clearly set forth in claims 35, 50, 52 that the reaction is carried out by adding the alkali silicate solution **over a period of at least one hour** while stirring.

This provides a clear distinction from the prior art where the reaction time in the extruder is ten minutes or less, preferable 1 to 5 minutes. This is apparent from the paragraph bridging pages 10 and 11. A translation of this text portion prepared by the undersigned who states that this is an accurate translation follows here:

*Processing of the multi-component mixture with simultaneous in situ formation of the water-insoluble silicates or silicate salts in the temperature range of, for example, 60 to 110°C requires generally a residence time of the multicomponent mixture under reaction conditions of up to 10 minutes. Significantly shorter reaction times, for example within the range of approximately 1 to 5 minutes may be sufficient and preferred. For more detail, reference can be had to the general knowledge of a person skilled in the art of controlling the mixing intensity, on the one hand, and the*

*material temperature, on the other hand, for effecting the desired degree of reaction and mixing of the material.*

Therefore, an important difference between the prior art and the present invention is the duration of the reaction. The prior art allows a maximum reaction time of 10 minutes while the present invention requires a minimum reaction time of 1 hour by adding the silicate solution (no solids are present!) within one hour while the reaction mixture is stirred within a batch mixer.

Also, it is apparent from the translation of *Ritter* provided by the applicant that the reaction according to the prior art reference, even though the same basic ingredients are being used, is entirely different from the reaction that occurs according to the present invention.

The prior art *Ritter* describes that water is used as an auxiliary agent in order to enable proper mixing (see p. 3, lines 25 to 27, of the attached translation): "limited amount of flowable aqueous phase is required in the mixture". Also, as stated on page 3, lines 6 to 8, of the translation, it is important that the aqueous phase can be predetermined and in particular limited. Note also that on page 1, lines 19 to 21, it is stated that the water quantities are used as an auxiliary phase and that the water is at least partially removed. See also page 3, lines 34-36.

Therefore, it is not suggested or taught to completely dissolve the alkali silicate; it is also not suggested to provide an aqueous solution or suspension of the reactants. This is also apparent from the use of an extruder as the mixing device. The beneficial effects of an extruder are pointed out several times, i.e., the great shearing forces. However, an extruder can only be used for mixing solids or highly viscous doughy materials and not liquids or solutions or suspensions.

As set forth on page 2, lines 16ff, and page 3, lines 25ff, of the translation, the reactions that occur in the extruder include initially the reaction of polyvinyl acetate and alkaline water glass to produce acetic acid as a result of the partial saponification of the polyvinyl acetate. The formation of acetic acid is an important step in the prior art reaction scheme. The acetic acid is known as a precipitation agent for silicate. The reaction of the

water-soluble silicate with the acetic acid causes the soluble silicate to become water insoluble and to form oligosilicate and polysilicate structures, particularly three-dimensional Q<sub>4</sub> structures (see page 3, lines 29-34). These insoluble silicate structures are the goal of the disclosed process (see also page 2, lines 23-25, of the translation) because these silicate structures impart water resistance to the end product (see lines 21-23 of page 2).

The intensive shearing forces of the extruder provide the desired physical mixing of organic and inorganic compounds as well as effects the chemical reactions taking place in that an optimized distribution of the water resistant precipitated water-insoluble silicate layers is ensured in the end product (page 4, lines 24-29). The doughy consistency of the mixture resulting from the disclosed mixing ratios requires the use of an extruder in order to distribute the reaction products (the insoluble silicates) throughout the polymer base.

It is also apparent from this disclosure that the precipitated silicates are the fillers that cause the rough surface of the extruded products.

The cited prior art therefore clearly teaches that:

1. a solution of the water glass is never produced and never intended to be produced;
2. the water glass that is partially dissolved is converted by chemical reaction to insoluble silicate structures acting as a filler to impart water resistance;
3. the water contents of the mixture being processed in the extruder is limited and never at a level to provide a solution or suspension; it is intended simply to allow proper mixing of the components in the extruder and can at most cause the water glass to be dissolved locally to then react to insoluble silicates by being precipitated by acetic acid, the precipitation being enhanced by the presence of calcium ions.

The first full paragraph of page 10 of the cited prior art reference reads as follows (translation provided by the undersigned who states that the translation is accurate):

*The water contents of the multi-component mixture introduced into the extruder is*

*generally significantly less than 50 % by weight; % by weight relative to the multi-component mixture of the non-aqueous mixture components. Suitable water contents are, for example, in the range of approximately 5 to 30 % by weight and in particular in the range of approximately 8 to 25 % by weight. Particularly suitable are water contents in the range of approximately 12 to 20 % by weight.*

Accordingly, *Ritter* sets forth a range of water contents of 5 to 30 % by weight. The examples provided in this reference show a water contents of 13 % in Example 1; 18 % in Example 2a; 16 % in Example 2b; 13.8 % in Example 2c; 13.2 % in Example 2d; 13.3 % to 15.9 % in Examples 3a to 3e; 16.6 % in Example 4; 14.6 % and 13.3 % in Examples 5a and 5b.

It is therefore apparent that the mixture of the cited prior art reference at no time contains more than the amount of water added to make the polyvinyl acetate flowable. As evidenced by the examples, this is within the range of 13 to 18 % and if taking into consideration the disclosure of page 10 is not more than 30 %. It is also not obvious to increase this amount because *Ritter* clearly sets forth that the water quantities should be limited in order to allow the formation of the water-insoluble calcium silicates.

According to the present invention, for producing the polymer component all starting materials are employed in aqueous solution or in aqueous suspension. The initial suspension is comprised of almost 50 % water as can be seen in Example 1. 1600 grams of polyvinyl acetate suspension and 120 grams of glycerol are mixed with 900 grams of water glass solution together with 171 grams of sodium hydroxide solution. The polyvinyl acetate suspension is 55 % and thus contains 45 % water. The sodium water glass solution is 40 % and contains 60 % water. Accordingly, the mixture contains 46 % water. The starting mixture of the present invention thus has a water contents that is at least twice as high as the water contents of the mixture being processed in the extruder according to *Ritter*.

The water contents is by no means a trivial factor because the viscosity of the reaction mixture and therefore the degree of mixing of the starting compounds is greatly influenced by it. The higher water contents and the use of starting materials in a dissolved

form or aqueous suspension provides for better mixing and thus more homogenous components and the silicate is finely divided as an organic silicate in the end product. The prior art reference makes reference to a **limited amount of aqueous phase** several times throughout the text (for example, page 3, lines 25-27). The prior art reference essentially processes a doughy mixture within the extruder. An aqueous suspension could not be processed in an extruder.

The primary purpose of employing water glass in the prior art reference is its conversion to **insoluble silicates of the oligosilicate and polysilicate type** that form **insoluble structures** for increasing water resistance of the component.

The calcium ions that are added according to the cited prior art *Ritter* are used to transform the dissolved water glass into **water-insoluble calcium silicate** that forms the filler of the end product providing the water-resistant properties.

In the present invention the calcium hydroxide is added in order to increase the presaponification of the polyvinyl acetate. It does not cause precipitation of insoluble calcium silicate. In the present invention, an aqueous suspension of polyvinyl acetate and the catalyst is prepared and the polyvinyl acetate is presaponified by adding the alkaline substance. The presaponification causes the polyvinyl acetate to be partially converted to hydrophilic polyvinyl alcohol. This increases the miscibility of polyvinyl acetate with water and provides a homogenous suspension that allows a finer dispersion of the polyvinyl acetate in the aqueous medium.

The present invention employs a batch mixer instead of an extruder and longer reaction times. The presaponified polyvinyl acetate suspension in the batch mixer is reacted with the alkali silicate solution for at least one hour. Given the presaponification of the polyvinyl acetate and the slow addition of the alkali silicate solution to the presaponified polyvinyl acetate, sufficient reaction time is provided to allow the polyvinyl alcohol that is formed in the presaponification step to react with the alkali silicate solution and to form organosilicates.

In the cited prior art reference, solid water glass is mixed with solid polyvinyl acetate or aqueous polyvinyl acetate in an extruder. The extrusion causes intensive shearing

forces as mentioned several times in the prior art reference. The reaction time in the extruder, as pointed out above, is 1 to 10 minutes. The reaction is carried out practically in a doughy phase and not in solution/suspension.

The component produced according to the invention has a water contents of 35 to 40 %. The product of the cited prior art reference can only have a water contents of maximally 30 % (see claim 8: 8 % to 25 %; see Examples: 13 % to 18 %). Moreover, in *Ritter* the water is removed in the last step of the extrusion by applying a vacuum.

Claim 35 sets forth a method having the following steps:

- a) providing an aqueous dispersion of polyvinyl acetate;
- b) adding a catalyst, selected from the group consisting of mono-hydroxy compounds, dihydroxy compounds, and trihydroxy compounds, to the aqueous dispersion;
- c) presaponifying the aqueous dispersion of polyvinyl acetate by adding an alkaline substance to the aqueous dispersion;
- d) providing an alkali silicate solution;
- e) reacting in a batch mixer the presaponified polyvinyl acetate of step c) with the alkali silicate solution of step d) by adding, while stirring, the alkali silicate solution to the presaponified polyvinyl acetate of step c) over a period of at least one hour to form organosilicates, wherein a combined water contents of the presaponified polyvinyl acetate and of the alkali silicate solution is greater than 40 %.

Even though the prior art provides the same starting materials, the same method is not disclosed. The prior art mixes all components in an extruder (see page 4, lines 14-32, of the translation) within a time period of 1 to 10 minutes. The present invention sets forth in claim 35 a step of presaponification. The presaponified polyvinyl acetate is present as such as a suspension and to this suspension of polyvinyl acetate a solution of alkali silicate is added in a batch mixer over a period of at least one hour. This step can by no means be obvious in view of *Ritter* where all materials are combined and forced through an extruder where they are mixed and reacted. There is never a solution of alkali silicate that, as such, is added over at least one hour. Also, as explained in detail above, the mixture of *Ritter* has a limited water contents of maximally 30 % - the method of the

present invention operates in a water contents range of more than 40 %.

Claim 35 is not obvious over the cited art.

Claim 50 refers to a variant without presaponification. However, the claim contains the important steps reacting in a batch mixer and adding the alkali silicate solution over a period of more than 1 hour to the suspension of polyvinyl acetate, where the water contents is greater than 40 %, and these steps are not disclosed or suggested by *Ritter*, as pointed out above, and claim 50 is therefore believed to be allowable as well.

Claim 36 sets forth that in step c) - presaponification - of claim 35 the alkaline substance is continuously added until a degree of hydrolysis of 10 % to 40 % is reached. The prior art, even though presaponification occurs in the reaction mixture, never carries out a separate presaponification step since all of the starting materials are reacted at once in the extruder - it is impossible to provide a presaponified suspension of polyvinyl acetate of the specified degree in the method of *Ritter* where all materials are mixed at once. Claim 36 is therefore not obvious in view of *Ritter*.

Claim 37 sets forth a particular pH value of the component. The pH value is of great importance because pH values above 9 in a mixture for producing thermoplastic starch (TPS) lead to discoloration of the final product, caused by decomposition of the starch, making the product unappealing to the consumer. The Example 6 of *Ritter* show that the resulting product is brown, i.e., the composition must have a pH value leading to decomposition of the starch and discoloration of the product. The inventive component which is to be used as an additive for producing thermoplastic starch polymers has a pH value outside of the critical range and thus leads to desirable white products.

Claim 38 sets forth that the alkaline substance is calcium hydroxide and that the calcium hydroxide is added until a degree of presaponification of 10 % to 40 % has been reached. *Ritter* discloses that the calcium ion delivering substance is used to form insoluble calcium silicate and not to presaponify the polyvinyl acetate. Claim 38 is therefore not obvious in view of *Ritter*.

Claim 51 defines a component for producing polymer blends from thermoplastic starch and a hydrophobic polymer, wherein the component is prepared according to the method of claim 35 and has a water contents of 35 % to 40 % (see specification, page 7,

3rd paragraph). Such a component is not disclosed or obvious in view of *Ritter* for the reasons presented above.

Claim 52 defines a component for producing polymer blends from thermoplastic starch and a hydrophobic polymer, wherein the component is comprised of:

organosilicates, formed by reacting an aqueous solution of polyvinyl acetate and an aqueous solution of alkali silicate in the presence of a catalyst, selected from the group consisting of mono-hydroxy compounds, dihydroxy compounds, and trihydroxy compounds, and an alkaline substance over a period of at least one hour, wherein the catalyst and the water of the polyvinyl acetate solution and of the alkali silicate solution are present in an amount of 35 to 40 % of the weight of the component;

wherein the component has a pH value of 7 to 8.5.

Again, the component is produced by reacting the components over a period of at least one hour in an aqueous phase (solution/suspension). The component contains 35 to 40 % by weight of water and catalyst. As discussed above, the prior art component, because it is produced in an extruder in a shorter period of time and with less water, cannot be the same; also, the prior art component contains insoluble silicates.

As pointed out above, the extruded product of *Ritter* or even any intermediate product within the extruder cannot have a water contents as claimed. Also, as discussed in detail above, the product of *Ritter* contains insoluble silicates as fillers and this is not the case in the present invention - organosilicates are formed due to the different reaction conditions, mainly the slow addition of the alkali silicate in the form of a solution to the presaponified suspension of polyvinyl acetate.

Applicant again would like to stress the point that it is well known in chemistry and chemical engineering that the reaction conditions have a great influence on the outcome of a reaction - the reaction products are not simply determined by what is being put into a reaction vessel. The type of reaction vessel, temperature, pressure, solvent, absence of a solvent, concentration of reactants all have an influence on the outcome of a reaction. This is well known to any chemist.

Therefore, even though same ingredients are being used, the outcome of a reaction between substances is controlled by the reaction conditions, in particular, whether a

reaction is allowed enough time, whether the substances are in solution, etc. The respective concentrations in solution and numerous other parameters are also important. Even the sequence of adding components to a reaction mixture leads to different products. Given the great differences in the reaction conditions (primarily, a solution of water glass used according to the present invention versus solid water glass being added; a reaction duration of at least one hour according to the invention versus 1-10 minutes according to *Ritter*), the examiner's contention that same ingredients will lead to same products is simply wrong.

The reaction course described in the cited prior art reference sets forth that insoluble silicates are formed and that these silicates are finely distributed within the end product. These silicates are fillers that impart water resistance to the mixture. No such insoluble silicates are formed in the present invention; carrying out the reaction in solution/suspension and allowing enough time for the components to react leads to the formation of organosilicates.

The inorganic fillers present in the product of *Ritter* prevents the composition to be used in a blowing process for producing films. Since the present invention employs water glass as a solution (no solids are present) and since organosilicates instead of insoluble silicates are formed, the material of the present invention provides products that have no rough surface and have a pure white color. The polymer blend that is produced with the inventive component is therefore suitable for preparing films that have a thickness of less than 100  $\mu\text{m}$ , as disclosed in the instant specification. The prior art describes blends that are extruded to have a width of 50 mm and a height of 0.5 mm (Example 1). Such ribbons or bands of a thickness of 0.5 mm do not constitute films as they are to be produced with the present intention.

The invention as claimed is not obvious in view of the prior art.

#### CONCLUSION

In view of the foregoing, it is submitted that this application is now in condition for allowance and such allowance is respectfully solicited.

Should the Examiner have any further objections or suggestions, the undersigned would appreciate a phone call or e-mail from the examiner to discuss appropriate

amendments to place the application into condition for allowance.

Authorization is herewith given to charge any fees or any shortages in any fees required during prosecution of this application and not paid by other means to Patent and Trademark Office deposit account 50-1199.

Respectfully submitted on March 1, 2004.

*Gudrun E. Huckett*  
Ms. Gudrun E. Huckett, Ph.D.  
Patent Agent, Registration No. 35,747  
Lönsstr. 53  
42289 Wuppertal  
GERMANY  
Telephone: +49-202-257-0371  
Facsimile: +49-202-257-0372  
gudrun.draudt@t-online.de

GEH

Encl.: time extension petition (1 sheet); translation *Ritter* (4 pages)

- 15 -

3/1/04: Amd for Ser. No. 09/403,557 - Inventor(s): Berger et al. - Filing Date: 10/25/1999

TRANSLATION OF RITTER - WO 96/37544  
(page 3, line 11, to page 7, line 6 from the bottom)

Subject Matter of the Invention

5

According to a first embodiment, the subject matter of the invention is accordingly a method for manufacturing a multi-component mixture based on polyvinyl acetate that is solid at room temperature and can be processed for shaping at elevated temperature and can contain also proportions of vinyl alcohol moieties in the polymer molecule and 10 is intimately mixed with an inorganic filler or filler mixture that is at least partially water-insoluble.

10

15

20

25

30

35

According to the invention, this method is characterized in that, for obtaining a multi-component mixture of increased water resistance, a flowable mixture of polyvinyl acetate containing water in limited amounts and at least partially water-soluble alkali silicate - in the following referred to for reasons of simplification as "water glass" - are intimately mixed at increased temperature and under the effect of strong shearing forces, wherein the water glass that is present is at least partially converted into water-insoluble silicate compounds and the water quantities that are introduced as an auxiliary phase from the multi-component mixture are at least partially removed. In an important embodiment of the teachings according to the invention, to the mixture comprised of polyvinyl acetate and water glass containing limited amounts of water calcium ion-delivering additives are added. In this connection, as a result of an in-situ reaction under the process conditions, to be explained in the following in more detail, water-insoluble calcium silicates are formed. Mixing of the starting materials and their in-situ reaction are realized preferably by treating the multi-component mixture in a heated extruder.

Subject matter of the invention according to further embodiments are the use of this method for obtaining biologically compatible shaped bodies of increased water resistance that are decomposable with regard to their organic contents as well as correspondingly shaped bodies as such.

Finally, the subject matter of the invention is the modification of the above defined method in such a way that the manufacture of the multi-component mixture of increased water resistance is carried out in the presence of thermoplastic starch as an additional

5 mixture component. In this connection, the thermoplastic starch can be introduced as a separately pre-processed material and/or can be introduced by means of in-situ formation in the multi-component mixture and can be at least substantially homogeneously distributed therein. In this modification, the teachings according to the invention include finally also the corresponding thermoplastic starch-containing multi-component mixture as well as shaped bodies formed thereof.

Details of the teachings according to the invention

10 The gist of the teachings according to the invention is the manufacture of a polymer blend of an organic polymer on the basis of polyvinyl acetate and inorganic compounds on silicate basis. The manufacture of this polymer blend is realized by means of reactive extrusion according to which the individual mixture components of the multi-component mixture are not only intensively physically mixed with one another, but with 15 this method at the same time chemical reactions between the components of the multi-component mixture are initiated. In particular, in an important partial reaction polyvinyl acetate and alkaline water glass are reacted with one another during the mixing process. Under the effect of the strongly basic aqueous alkali silicate component a partial saponification of the polyvinyl acetate takes place. Accordingly, vinyl alcohol 20 moieties are formed on the polymer and acetic acid is produced that, as is known in the art, is a precipitation agent for water-soluble silicates. As a result of the precipitation, the silicate becomes water-insoluble and increases in this way the water resistance of the blend.

25 For enhancing and controlling the silicate precipitation, calcium ion-producing additives can be added to the multi-component mixture which react simultaneously by in-situ reaction to the corresponding water-insoluble calcium silicates. In this way, a further improvement of water resistance of the multi-component mixture can be adjusted.

30 The teachings according to the invention also provides to couple and combine the mechanical process of mixing of the materials with the course of the chemical reaction(s) so that in the finished product spatial correlations of organic and water-insoluble inorganic components are formed that provide increased protective action by means of these water-insoluble component proportions in order to counteract water 35 penetration without this endangering the long-term decomposability of the polymer components based on vinyl acetate and/or vinyl alcohol. In detail the following applies:

The mixture components of the multi-component mixture according to the invention:

5 The organic polymer component is polyvinyl acetate that is used according to an important embodiment at least partially as an aqueous polyvinyl acetate dispersion or emulsion. It can be expedient to use additionally solid polyvinyl acetate powder together with such an aqueous presentation form. The important idea in this context is to be able to predetermine and in particular to limit the amount of aqueous phase that is to be introduced into the multi-component mixture; see the following.

10 The inorganic main component to be also used according to the invention is alkali silicate that is at least partially water-soluble. Preferred is in this connection the use of correspondingly water-soluble sodium silicate components that are generally known as "water glass". Sodium silicates of the type used in this connection are characterized by their so-called module values, i.e., the molar ratio of silicon dioxide to alkali oxide, in particular sodium oxide. Suitable are in particular corresponding water glass used in the detergent chemistry. Their module values (molar ratio  $\text{SiO}_2 : \text{Na}_2\text{O}$ ) in the inventive use is generally in the range of 0.8 to 4, preferably in the range of 1.5 to 3.0. Sodium water glass with module values in the range of 1.7 to 2.5 or 2.7 can be very expedient. Suitable is for example a sodium water glass product that is sold by the applicant under the trade name "Portil A" and has a module value of approximately 2.

In a preferred embodiment, the water glass component is used in the process as a solid powder.

25 For triggering and securing the desired chemical reactions according to the invention during intensive mixing of the components, a limited amount of flowable aqueous phase is required in the mixture. As already mentioned, it is particularly easy to introduce this intermediate reactant in the form of aqueous polyvinyl acetate preparation into the reaction mixture. The water glass powder dissolves during mixture in the aqueous phase and generates a strongly alkaline medium so that at least a partial saponification of polyvinyl acetate is effected. The acetic acid that is formed acts, as is known in the art, as a precipitation agent for silicate and the soluble water glass reacts to form water-insoluble oligosilicate and polysilicate structures, in particular the so-called three-dimensional  $\text{Q}_4$  structures. The water that serves as an auxiliary agent for mixing and in the in-situ chemical reaction can be removed from the mixture in the end. This will be explained in the following in more detail.

Depending on the employed mixing ratios of polyvinyl acetate on the one hand and water glass on the other hand, as well as the selected individual process conditions, it can be expedient to additionally enhance the formation and precipitation of insoluble 5 silicate compounds. For this purpose, the inventive teaching suggests the additional use of calcium ion-providing mixture components. Considered are calcium salts particularly of inorganic acids, e.g. calcium chloride, calcium sulfate, and/or calcium carbonate; primarily however calcium oxide and/or calcium hydroxide. The increased precipitation of water-insoluble silicate compounds caused by these co-reactants results 10 in further improvement of the water resistance of the finished multi-component mixture.

The processing and reaction conditions:

The method according to the invention proposes according to a preferred embodiment 15 a continuous simultaneous combination of mixing and desired chemical reaction by treating the multi-component mixture in an extruder. In particular, known heated extruders are used that enable controlled heating of the materials to be mixed with regulation of the maximum product temperature in the extruder, on the one hand, because of the high mechanical mixing energy and, on the other hand, by additionally 20 heating the exterior. It is preferred in this context to operate in the treatment end phase in the extruder at material temperatures in the range of 100°C, particularly slightly above 100°C. In this way, it is possible to remove in the final stage of the extruder treatment the water contents as water vapor from the mixed materials, particular by using vacuum 25 in the end phase of the extruder treatment, as is known in the art. The use of intensive shearing forces upon passing the multi-component mixture through the extruder not only provides the desired physical mixing of the organic and inorganic components with one another, but at the same time the course of the desired in-situ chemical reactions is enhanced, and, in this way, an optimized distribution of the water-resistant precipitated 30 water-insoluble silicate layers in the mixed material is ensured. This represents apparently the decisive difference in comparison to simple mixing of polymers based on polyvinyl acetate and corresponding inorganic insoluble fillers in the absence of the important simultaneous chemical reactions according to the invention.